

Planning and Presenting an Internetworking Competition

An Instruction Manual



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Introduction

This manual includes instructions for planning and presenting an internetworking competition. An internetworking competition provides an opportunity for individuals pursuing careers in internetworking to demonstrate their skills in a practical testing situation. An internetworking competition also gives institutions and organizations the opportunity to foster enthusiasm for the Internet and to reward excellence in the field.

Because each competition is unique, this manual is a general introductory guide. The needs of your organization will drive the specific choices you make for your competition.

The following summary describes the objective of each section of this manual.

- Chapter One offers suggestions for thoroughly planning your competition.
- Chapter Two describes the events that happen at a typical competition, the materials and equipment that you'll need for each event and what you and the contestants will do during each event.
- Chapter Three addresses what to do after your competition to ensure closure and how to use what you've learned at a competition to improve the quality of your next competition.

Following Chapter Three are five appendixes, including a materials and equipment checklist and examples of competition documentation.

Chapter One: Planning the Competition

Use the following guidelines when you plan your competition.

Form a competition committee. Choose three to five individuals to act as a competition committee. Typical committee members have a technical background and a passion for the advancement of the Internet. Educators and other professionals with a vested interest make the best members. Use volunteers sparingly.

Define the role of each committee member. Choose one member of your committee to serve as the committee chair. Choose other members to judge the competition events and identify the winners. Decide what member is responsible for each of the tasks described in this manual.

Engage sponsors. Identify individuals and institutions that share your committee's vision and engage them as sponsors.

Choose prizes. In conjunction with your sponsors, choose the prizes that you will award the competition winners. Typical prizes are scholarships, testing equipment, shirts, books, software and hardware.

Choose a facility. Arrange for the use a facility that meets the physical needs of your competition in terms of size, floor plan, power capacity, network connectivity and the placement of electrical outlets. Typical venues are classrooms for small-scale competitions, and exhibition halls for large-scale competitions.

The facility you choose must include an area to use as a *staging area*. The staging area is where contestants and judges wait between events. The facility must also have an *observation area*. The observation area is where interested parties may observe the competition events without interacting with the contestants.

If the facility is too small it may jeopardize fairness. If the facility is too large it will require additional committee members to manage it.

Safety is the most important issue.

Determine the scope. Determine how many contestants will participate. Typically a competition involves no more than 50 contestants.

Publicize the competition. To attract contestants, publicize your competition in stages. Release your first publicity at least six weeks in advance of the competition date, and then release additional publicity every two weeks. Use media such as local newspapers and relevant Web sites. Provide detailed information about competition events, judging criteria, dress code and any materials and equipment that the contestants need to bring. Set clear expectations. For more information, see Appendix B: Competition Publicity, on page 22.

Plan the competition events. Determine what events your competition will include, and what internetworking skills you will evaluate. Design the events to be difficult enough to challenge advanced contestants. Then, for each event:

- Set a time limit.
- Specify the criteria you'll use to evaluate it.
- Specify a objective method of scoring it.

For more information, see Chapter Two, pages 7-18; Appendix D: LAN/WAN Design Evaluation Form, pages 25-6; and Appendix E: Competition Scoring Sheet, page 27.

Gather materials and equipment. Gather the following materials to use at your competition.

- Signs that identify each event station
- Nametags
- Score sheets
- Paper
- Pens
- A list of contestants' and committee members' names and phone numbers
- Letters of congratulation
- Certificates of participation
- Notebooks in which committee members record their experiences and wish lists

For a list of the materials and equipment you'll need for each competition event, see Chapter Three. For a materials and equipment checklist, see Appendix A on pages 20-1.

Ship and receive materials and equipment. Arrange for the shipment of your materials and equipment to the facility where you hold your competition. As a security measure, designate committee members to be present at the facility when the shipment is delivered.

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At the facility where you hold your competition, follow these guidelines.

Set up the materials and equipment. Set up your event stations, staging area and observation area.

Test the equipment. Test all the equipment to make sure it works properly before the competition begins. Test routers and other hardware one week in advance. Set up and test the equipment at least one day before the competition date and then test everything again on the morning of the competition.

Chapter Two: Presenting the Competition

During your competition, follow these guidelines.

Identify the contestants by numbered nametags. A numbering system ensures anonymity among the contestants during evaluation.

Organize the contestants into modules that are manageable. Break up the stations and equipment in each station to accommodate the size of the modules. All modules should be equal in size and every participant in each model should be performing the same task at the various stations simultaneously.

Required Clothing. Contestants should be dressed in the typical attire of a networking professional.

Manage the pedestrian traffic. Manage the pedestrian traffic created by your contestants, committee members and interested parties such as advisors and family members of the contestants. Make use of the staging and observation areas to reduce the traffic near the event stations. Allow for observation by interest parties, but prevent their interaction with the contestants. Keep the contestants moving from one station to the next.

Keep a notebook and a wish list. Record your impressions of the competition, and keep a wish list. When planning your next competition, you can improve its quality by reviewing your notes and incorporating your committee members' suggestions.

The remainder of this chapter describes the events of a typical competition.

Event 1: Structured Cabling, Part I

Objective: Contestants demonstrate how to make patch cable, crossover cable and rollover cable.

Time limit: 30 minutes

Each contestant needs:

- 30 feet Category 5 stranded cable.
- 100 feet Category 5 non-stranded cable.
- 10 male RJ45 plugs.
- Two to four 24-port patch panels. Note: Two to four contestants can use each patch panel.
- Two to four male RJ45 plug.
- One or two telecommunication boxes.
- One or two single-gang port faceplates.
- One Category 5 termination tool.
- One punch-down tool with a 110 blade.
- One pair of wire scissors (or a wire cutter).
- One screwdriver.
- One cable tester.
- One pair of safety glasses.
- Cable management materials. (Example: Velcro ties)
- One cable labeler.

Each judge needs:

- One cable tester.
- One pair safety glasses.

Additionally, you need:

- One equipment rack for every 30 contestants.
- One judge for every three contestants.

During this event, judges:

- Give each contestant 10 male RJ45 plugs.
- Give each contestant 30 feet Category 5 stranded cable.
- Wear safety glasses.

During this event, contestants:

- Make three types of cable (patch cable, crossover cable, and rollover cable) within the 30-minute time limit.
- Label the cables with their contestant numbers.
- Wear safety glasses.

After the event, contestants:

- Present completed cables and remaining male RJ45 plugs to the judges for inspection.

To evaluate a contestant's performance, judges:

- Record the amount of time the contestant took to complete the event.
- Record the quantity of male RJ45 plugs used by the contestant.
- Test the cables.
- Inspect the labeling of the cables.
- Apply the established criteria concerning craftsmanship.

When scoring the event, judges:

- Deduct points for each male RJ45 plug used in excess of six.
- Award no points for a cable that fails testing.
- Deduct points if a contestant does not wear safety glasses.
- Use contestants' timings to break a tied score.

After the event, judges:

- Report the results to the contest chair.

Event 1: Structured Cabling, Part II

Objective: Contestants demonstrate proper punch-down into a patch panel, punch-down into a telecommunications box, cable management, cable labeling, and the use of a cut sheet.

Time limit: 45 minutes

During the event, judges:

- Distribute to each contestant a cut sheet that includes the correct port and cable labeling schematics.
- Assign each contestant a pair of ports to terminate, as designated on the cut sheet.
- Give each contestant one telecommunications box, one faceplate, and two female RJ45 plugs.
- Record the amount of time each contestant takes to complete the event. (When scoring the event, judges can use a contestant's timing to break a tie.)
- Wear safety glasses.

During the event, contestants:

- Use a tool kit that includes a punch-down tool, a pair of wire scissors (or a wire cutter), and a screwdriver.
- Assign a punch panel and port numbers according to the cut sheet.
- Cut the length of cable from the Category 5 cable box, as specified on the cut sheet.
- Punch down the two female RJ45 plugs, and mount them in the faceplate and the telecommunications box. Note: If there is a freestanding wall, contestants mount the telecommunications box on the wall.
- Punch down into the punch panel.
- Mount the panel into the rack.
- Demonstrate cable management techniques. (Example: Contestant use the equipment rack and Velcro ties.)
- Label the cable at two-foot intervals, and three times on both ends.
- Leave a 10-foot service (excess) coil at both ends of the cable.
- Wear safety glasses.

After the event, contestants:

- Present completed work to the judges for evaluation.

To evaluate a contestant's performance, judges:

- Consider the craftsmanship of the punch-down. (Example: Judges examine the color codes and amount of wire used.)
- Test the connections.
- Examine the cable labeling.
- Examine the service coil.
- Consider the contestant's cable management techniques.
- Examine the mounting of the telecommunications box and faceplate.

When scoring the event, judges impose a penalty if a contestant fails to:

- Label the cable.
- Leave service coil.
- Wear safety glasses.

Judges also impose a penalty:

- For every punch-down that the contestant has to pull and punch again.

After the event, judges:

- Report the results of the event to the contest chair.

Event 2: Multiple-Choice Examination

Objective: Contestants demonstrate knowledge of internetworking concepts by correctly answering multiple-choice questions.

Time limit: one hour

You need:

- The same number of computers equal to the size of a module capable of running the latest Web browsers.
- A network with Internet or file-server access.
- An internetworking examination that includes approximately 60 questions. (Example: A CCNA—Cisco Certified Network Associate—practice examination.)

In the event that technical difficulties prevent the use of an online examination, you also need:

- Hard copies of a back-up examination.
- The answer key to the back-up examination.

Before the written examination, judges:

- Arrange the room so that no contestant can see another contestant's computer screen. (Example: Judges set up partitions between computers.)
- Set up the examination on each computer. (Example: Judges copy an examination file from a diskette to each computer's hard drive.)

During the examination, judges:

- Ensure that contestants use no materials other than scratch paper and pencil.
- Prevent contestants from beginning before the designated start time.
- Announce the start time.
- Proctor the examination.
- Manage pedestrian traffic near the examination area.
- Record the amount of time each contestant takes to complete the examination.
- Announce the end time.

After the examination, judges:

- Score the examination.
- Record the scores.
- Report the results to the contest chair.

Event 3: Router Configuration

Objective: Contestants perform tasks related to router configuration, including defining a range of IP numbers, dividing the network into subnets, configuring each port of the router, configuring the global router set, configuring a firewall, defining passwords and connecting to a Web server. Each contestant's router is interdependent on the other contestants' routers.

Time limit: 60 minutes

Each contestant needs:

- A router. (Example: A Cisco 2514 router)
- A table or desk on which to place the router.
- A set of DTE cables.
- A set of DCE cables.
- A logical diagram, created by the judges.
- A configuration data sheet, created by the judges.
- A DB-9 connector.
- Rollover cable.
- Ethernet transceivers.
- Ethernet patch cables.
- Ethernet hubs.
- An Ethernet adapter for the contestant's laptop computer.

Note: Contestants need Ethernet transceivers, patch cables, hubs and adapters only if using routers that require them.

Before the event, judges:

- Assemble a physical layout.
- Set up the physical connections of the routers.
- Ensure that each router is working properly.
- Set up a Web server.
- Create a home page.
- Define a Web site address.
- Test the design.
- Modify the design as needed.
- Test the modified design.
- Assign a router to each contestant.

During the event, judges provide each contestant with a copy of:

- The logical diagram.
- The physical diagram.
- The description of the router configuration problem to be solved.

During the event, contestants:

- Design an IP numbering scheme.
- Designate the subnet to which each router connects.
- Define firewall attributes.
- Define console, secret, enable, and VTY passwords.
- Define routed protocol.
- Define routing protocols.
- Define encapsulation.
- Define port assignments.
- Connect to an assigned Web server.
- Connect to the router via the console port, using a DB-9 connector and rollover cable.
- Configure the HyperTerminal program in Microsoft® Windows®.
- Use Telnet or a ping test to demonstrate that all ports can connect to the Web server.
- Connect from a laptop computer to the router via Telnet and Ethernet.

After the event, judges:

- Print the HyperTerminal configuration

To evaluate a contestant's performance, judges examine the:

- HyperTerminal configuration.
- Telnet connection.
- Router connectivity.
- Access to the Web server.
- IP hosting.
- Four passwords.
- Firewall configuration.
- Router protocols.
- Encapsulation.

After the event, judges:

- Record the amount of time each contestant takes to complete the event.
- Report the results to the contest chair.

Event 4: Router Troubleshooting

Objective: Contestants demonstrate the ability to troubleshoot problems related to IP port configurations, encapsulation, passwords, access lists and the physical connections of a router.

Time limit: 10 minutes per router

Before the event, judges:

- Set up the physical connections of the routers.
- Configure each router according to the previously designated guidelines.
- Ensure that each router operates properly.
- Create three to five bugs on each router. Each router must work properly before the judges create bugs on it. Judges create the same number of bugs on each router. (Example: After determining that each router works properly, judges reverse DCE and DTE cables, turn ports off, and change host names.)
- Print the running configuration as a means of documenting the bugs created.

Judges assemble materials packets that include:

1. The running configuration.
2. The physical diagram.
3. An answer sheet for each router.

During the event, judges:

- Assign each contestant to a particular router.
- Distribute a materials packet to each contestant.
- Prevent contestants from sharing answers.
- Record the amount of time each contestant takes to complete the event.

During the event, contestants:

- Move from the original router to each of the other routers, using the answer sheet included in the materials packet to describe each bug and the procedures for fixing it. Note: Contestants do not change the router configurations.
- Connect to the router's console port using a DB-9 connector and rollover cable.
- Configure HyperTerminal. Note: After a contestant configures HyperTerminal, it is configured for all routers.

After the event, contestants:

- Give their answer sheets to the judges.

After the event, judges:

- Score the answer sheets.
- Report the results to the contest chair.

Event 5: LAN/WAN Design

Objective: Contestants demonstrate the ability to design a LAN (Local Area Network) or WAN (Wide Area Network), issue the required documentation and conduct an interview with a potential “client,” i.e., a competition judge.

Each contestant needs:

- A blueprint or floor plan. Note: The blueprint includes doors, restrooms and other obstacles.
- An electrical description of the building.
- A description of the building’s HVAC (heating, ventilation, and air conditioning) system.
- A user specification sheet.
- A personal computer with Visio, Cisco ConfigMaker or Cisco Network Designer installed.
- Printing capability.

Before the event, judges:

- Distribute copies of the design assignment to the contestants. Note: Preferably, judges distribute the design problem one day before the competition and no later than at the beginning of the competition.
- Prepare 10 interview questions.
- Specify the information that each contestant includes in the documentation.
- Assign interview times.
- Assign deadlines for documentation.

During the event, judges:

- Conduct an interview with each contestant. Note: Judges play the roles of potential clients.

During the event, contestants:

- Examine the blueprint or floor plan to identify the following.
 1. The locations of the MDF (main distribution frame) and the IDFs (intermediate distribution frames)
 2. The number of host stations
 3. The various departments of the business
 4. The security needs of the business
 5. The location of the enterprise server

- Produce documentation that includes the following information about the LAN/WAN.
 1. A cut sheet
 2. A logical diagram
 3. A physical diagram
 4. An IP numbering scheme
 5. MDF and IDF physical layouts
 6. A price quote on the cost of the equipment
 7. The time required to set up the LAN/WAN

To evaluate each contestant's performance, judges examine:

- All the information included in the contestant's documentation.

After the event, judges:

- Score each participant's performance according to the established criteria.
- Report the results to the contest chair.

Chapter Three: Following the Competition

After the contestants complete all the competition events, allow several hours for the judges to identify the winners. Use contestants' timings to break tied scores. Follow these guidelines to close the competition.

Present prizes and certificates of participation. Announce the names of the competition winners and present their prizes. Present a certificate of participation to every contestant.

Photograph the contestants and judges. Photograph all the participants. You can use the photographs when publicizing your next competition.

Solicit feedback from the contestants. Before the contestants leave the facility, solicit their feedback on the competition. Find out what they liked and what they didn't like. Use their suggestions to improve the quality of your next competition.

Publish the competition results. Publish the names of the winners and a summary of the competition in local newspapers and on relevant Web sites.

Tear down the equipment. Tear down the equipment, event stations, signs, and all other materials. Pack the materials and equipment and arrange for their shipping. Allow several hours for the tear down.

Evaluate the competition. In addition to the feedback solicited from the contestants, use the committee members' impressions and wish lists—recorded in their notebooks during the competition—to evaluate the competition and the role of each committee member.

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Appendix A: Materials and Equipment Checklist

Use the following checklist to help organize the materials and equipment you need for your competition.

Hardware and Other Equipment

- ☐ Personal computers with Visio, Cisco ConfigMaker or Cisco Network Designer installed, capable of running the latest Web browsers
- ☐ Printers
- ☐ Category 5 stranded cable
- ☐ Category 5 non-stranded cable
- ☐ Female RJ45 plugs
- ☐ Male RJ45 plug
- ☐ 24-port patch panels
- ☐ Telecommunication boxes
- ☐ Single-gang port faceplates
- ☐ Category 5 termination tools
- ☐ Punch-down tools with 110 blades
- ☐ Pairs of scissors (or wire cutters)
- ☐ Screwdrivers
- ☐ Cable testers
- ☐ Safety glasses
- ☐ Cable management materials such as Velcro ties
- ☐ Cable labelers
- ☐ Equipment racks
- ☐ A network with Internet or file-server access
- ☐ Routers
- ☐ Tables or desks
- ☐ DTE cables
- ☐ DCE cables
- ☐ DB-9 connectors
- ☐ Rollover cables
- ☐ Ethernet transceivers (if required by servers)
- ☐ Ethernet patch cables (if required by servers)
- ☐ Ethernet hubs (if required by servers)

Additional Materials

- ❑ Blueprints or floor plans of the facility
- ❑ Descriptions of the facility's electrical system and HVAC
- ❑ User specification sheets
- ❑ Logical diagrams
- ❑ Configuration data sheets
- ❑ An online internetworking examination
- ❑ Hard copies of a back-up examination
- ❑ Answer keys to the back-up examination
- ❑ Cameras
- ❑ Signs to identify event stations
- ❑ Nametags
- ❑ Score sheets
- ❑ Paper
- ❑ Pens
- ❑ Lists of contestants' and committee members' names and phone numbers
- ❑ Letters of congratulation
- ❑ Certificates of participation
- ❑ Notebooks for committee members

Appendix B: Competition Publicity

The following document is an example of written communication with prospective contestants for the purpose of outlining the competition's objectives.

Internetworking Skills Competition

Competition Objectives

The competition consists of two parts—a written examination and a hands-on lab.

The objective of the written examination is to measure each contestant's knowledge of internetworking concepts. Questions on the written examination treat the following topics.

- The OSI model and industry standards
- Network topologies
- IP addressing (including subnet masks)
- Networking components
- Basic network design
- Router configurations
- Routed and routing protocols
- LAN-switching theory and VLANs
- Advanced LAN and LAN switched design
- Novell IPX
- WAN theory and design
- WAN technology, PPP, Frame Relay, and ISDN
- Network troubleshooting

The objective of the hands-on lab is to measure each contestant's ability to design, install and maintain a network. Given a set of networking equipment (Example: cable, hubs, and routers) and a time limit, each contestant will install a network and demonstrate that an Internet application can run successfully on it. (Example: A Web browser, FTP, or Telnet)

Appendix C: LAN/WAN Design Assignment

The following document is an example of the LAN/WAN design assignment given to contestants during Event 5.

LAN/WAN Design Problem (10 points)

Grover's Toy Company, a toy manufacturer in Kansas City, wants to expand its product line to include Internet games. The company will convert its current training area to a game design area. Grover's employs 24 people who work on site. Many other people visit the site to receive training in graphics design, computer programming, marketing, and sales. Grover's wants to deliver its Web-based products from the Kansas City building to its corporate server in Atlanta. The company expects to dominate the market in Internet games for children ages 2 to 6 first and plans to target the 7 to 12 and the 13 to 18 age groups later.

Assignment: Design a network that can support the following requirements.

1. Six to twenty-four individuals attend training courses at the same time.
2. The permanent offices are Rooms 105-108. Telecommuters who need an Internet station when they work on site use cubicles C62-C88. The design staff and the sales staff may also use these cubicles. Room 103 will become a TV studio used for multi-media tapings.
3. Rosita Lab is where the animators and programmers meet to check links and animations. The Ernie, Bert, Elmo, and Zoe training rooms will become the game project areas for each product respectively. Four to six employees work in these areas.
4. The sales staff will use the Big Bird training room primarily, and will also use Room 103 for conferences and demonstrations.
5. The Project Manager uses Room 134.
6. The Web site management team uses Rooms 128-131. Room 131 is the Web site manager's office.

Installation Instructions:

- Run all cabling through existing conduit.
- The drawing scale is 1" = 20'
- The sales staff doesn't want the design staff to have access to the sales staff's files, and visa versa.
- The Project Manager needs access to the files of both the sales and design staffs.
- The Project Manager has requested a T3 line for the WAN.
- The LAN will run Ethernet 100BaseT.
- Use Category 5 horizontal cabling.
- The sales, design, and Web site staffs each have their own servers. The sales and Web site staffs have access to the Web site, but the Web server can't access the sales or design servers.
- Create a cut sheet using the drawing of Grover's Toy Company.
- Locate the MDF and any needed IDFs.
- List the devices to be located in the MDF/IDF.
- Determine an IP-addressing scheme and computer-naming scheme.
- Develop internal security (ACLs).
- Identify the pros and cons of the design.
- Create charts and diagrams for use during your client presentation.
- Your client presentation lasts 10 minutes, including a Q&A segment.

Appendix D: LAN/WAN Design Evaluation Form

The following document is an example of the form used to evaluate a contestant's LAN/WAN design following Event 5.

LAN/WAN Design Scoring Sheet

Contestant # _____

	Item	Scoring Criteria	Points	Score
1	Logical design model	Devices, connections, HCC,VCC	5	
2	Physical design (architectural drawing mark up)	Cut sheet (cable length, identification, neatness), location of MDF and IDFs	5	
3	MDF/IDF descriptions	Number of connections Type of cable media for all horizontal and vertical runs	5	
4	IP-addressing scheme	Order, expandability	5	
5	Network analysis	Analysis of pros and cons of the network	10	
6	ACL design	Documentation of the purpose of the ACLs Logical diagram describing the overall effect of the ACLs	10	

7	WAN design	<p>WAN line speeds and upgrade path</p> <p>Model of traffic flow</p> <p>List of additional equipment such as DSU/CSUs</p> <p>Summary of the benefits of the design</p>	5	
8	PPP design	Documentation of the router commands necessary to implement PPP on the router	5	
9	ISDN design (if used)	<p>Description of overall bandwidth available to the site, and the mode of data communications</p> <p>Data communications equipment needed</p>	5	
10	Frame Relay design (if used)	<p>DLCI</p> <p>Value of the CIR</p> <p>Data communication equipment needed</p> <p>Benefits of Frame Relay for this type of implementation</p>	5	
11	Client presentation (visual)	<p>Charts and diagrams</p> <p>Clarity, neatness, selling points</p>	5	
12	Client presentation (oral)	<p>Defense of design</p> <p>Q & A segment</p> <p>Visual contact</p>	5	
		Total points = 70	70	

Appendix E: Competition Scoring Sheet

The following document is an example of the form used to evaluate a contestant's overall performance during the competition.

Internetworking Competition

Overall Score			
1	<u>Event</u>	<u>Criteria</u>	<u>Percentage of Overall Score</u>
2	Cable termination	Includes making cables and punching down	15 %
3	LAN installation	Includes IP addressing	15 %
4	WAN connection	Includes router configuration	15 %
5	Troubleshooting	Debugging the installation	15 %
6	Design	Includes cut sheet and logical diagram	15%
7	Design	Includes cut sheet and logical diagram	15%
8	Written examination		15 %
9	Professionalism	Includes dress, behavior, attitude, and client interaction Resume submitted via email	10 %
	Total		100

Notes